

Identifying and Cataloging Water Pollution Sources by Watershed Using Aerial Thermal Infrared Imaging and GIS

Sewickley Creek Watershed

Youghiogheny-Monongehela Rivers

Dunkard Creek

North Fork River

Omega Mine Complex

T&T Mine Complex

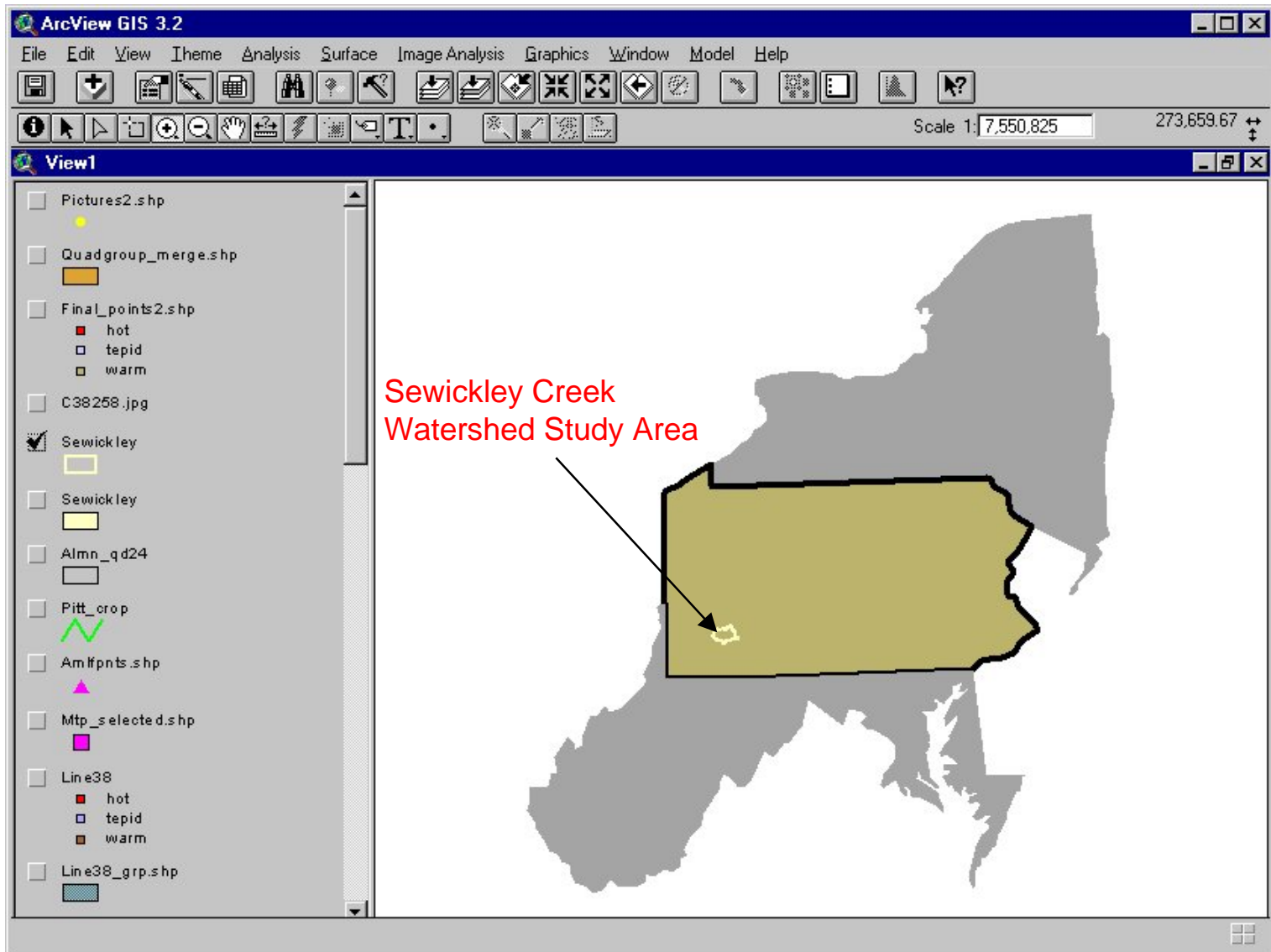
Muddy & Roaring Creek Watershed

Winding Ridge site

Kempton Site



Sewickley Creek Watershed



Aerial Infrared Remote Sensing Data (Sewickley Creek Watershed)

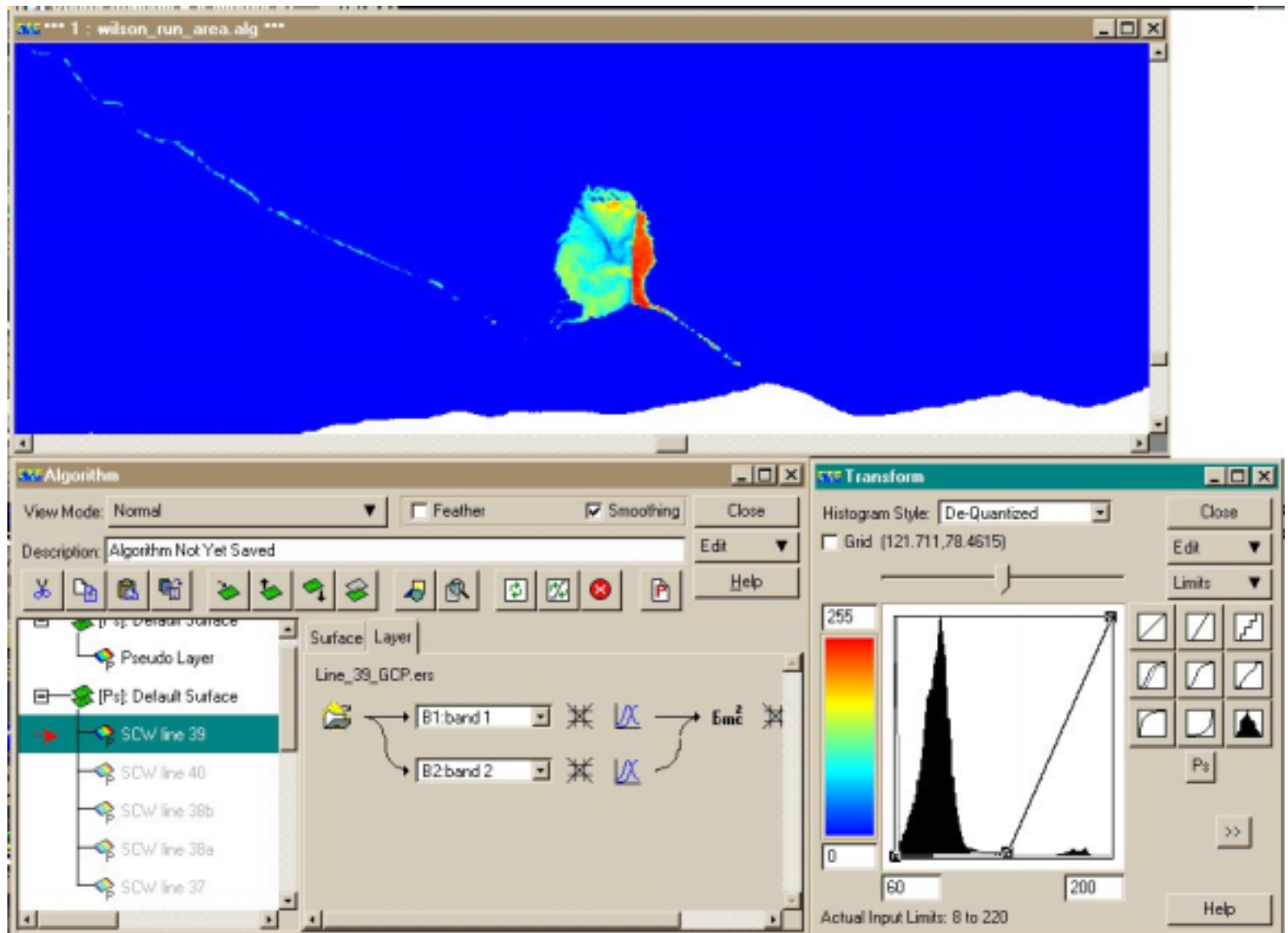
- **Acquired from helicopter platform (~1325' AGL)**
 - Night multispectral (2 band) 3-5 micron & 8-12 micron (nominal)
 - Temperature resolution $\sim 0.1^{\circ}\text{C}$
 - Dynamic range 8 bits (0-255)
- **GCS level 1 corrected**
 - IMU navigation data + differential GPS
 - Cell dimensions 1m^2
 - Size (55 flight lines) $\sim 5.2\text{GB}$



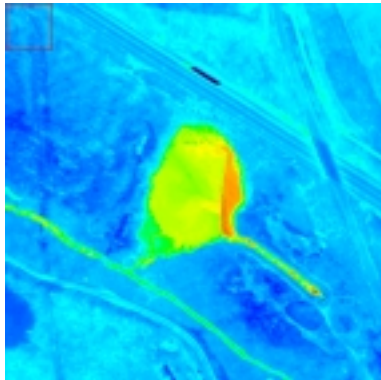
Raw Infrared Imagery



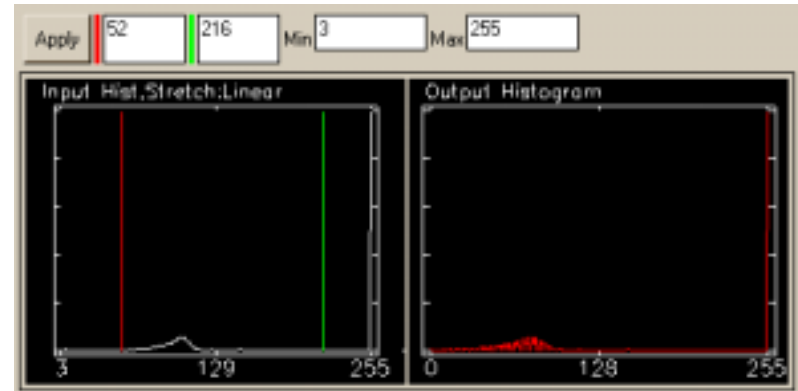
Colormapping and Transformation



Transformations/Enhancements



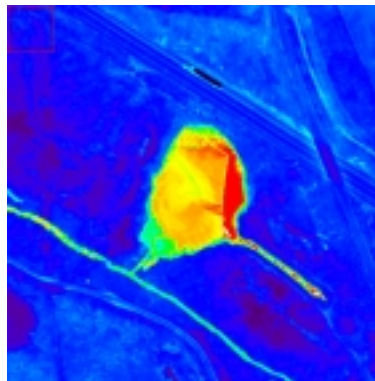
+



Colormapped Image

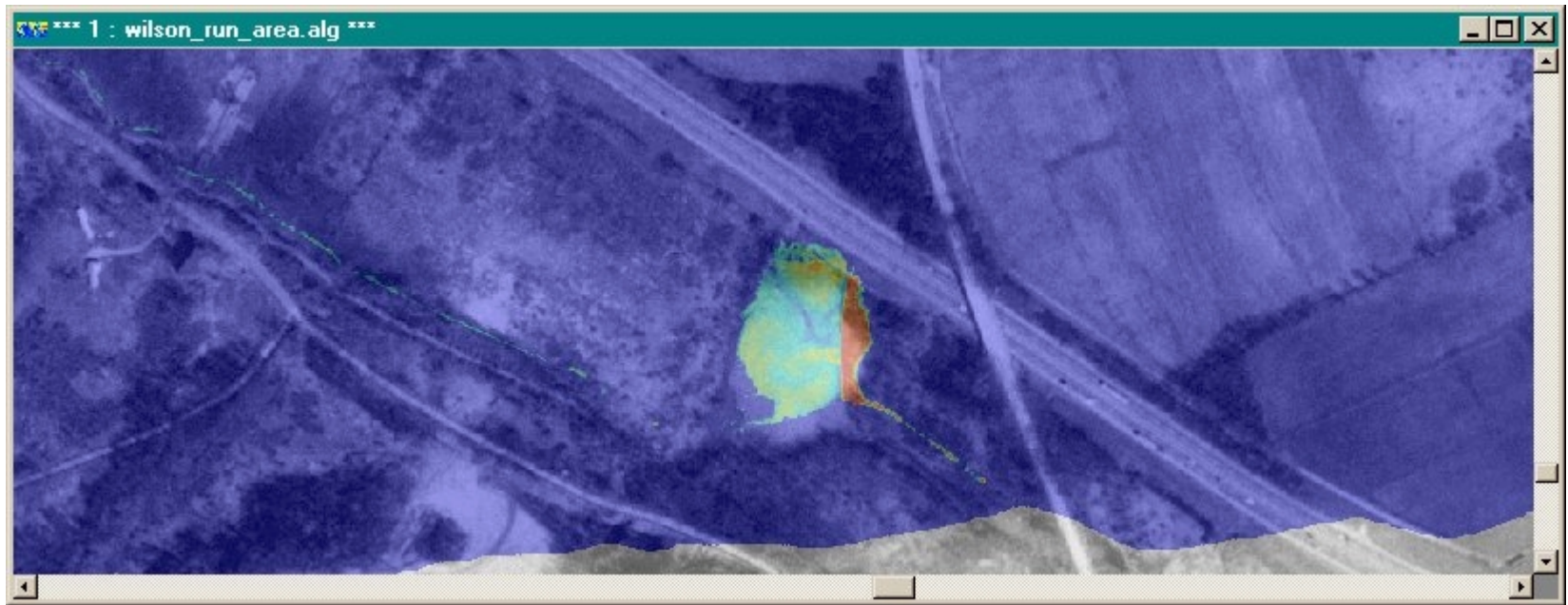
Image Histogram Stretch

=



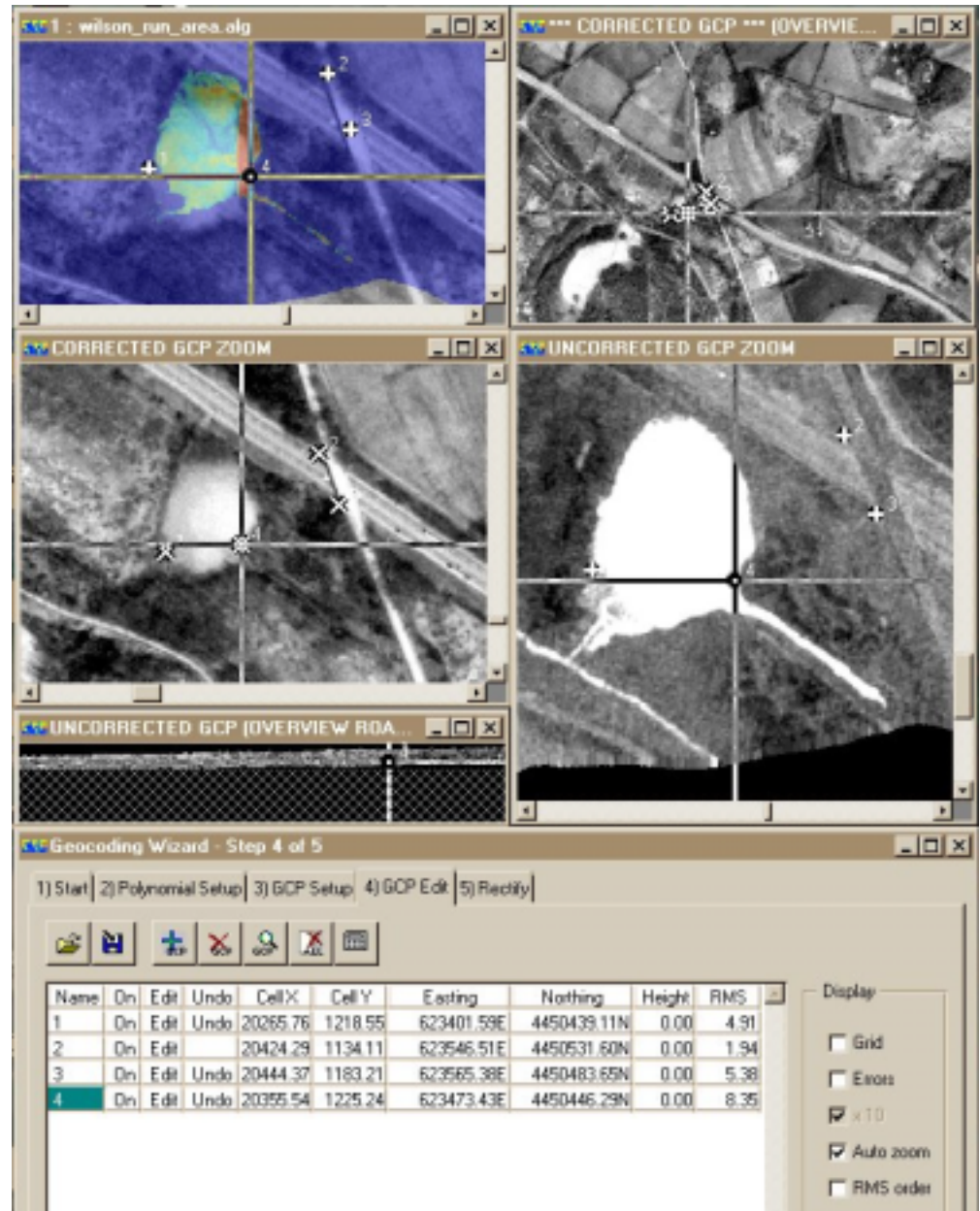
Enhanced Colormapped Image

Colormapped/transformed IR imagery layer superimposed on DOQQ reference image

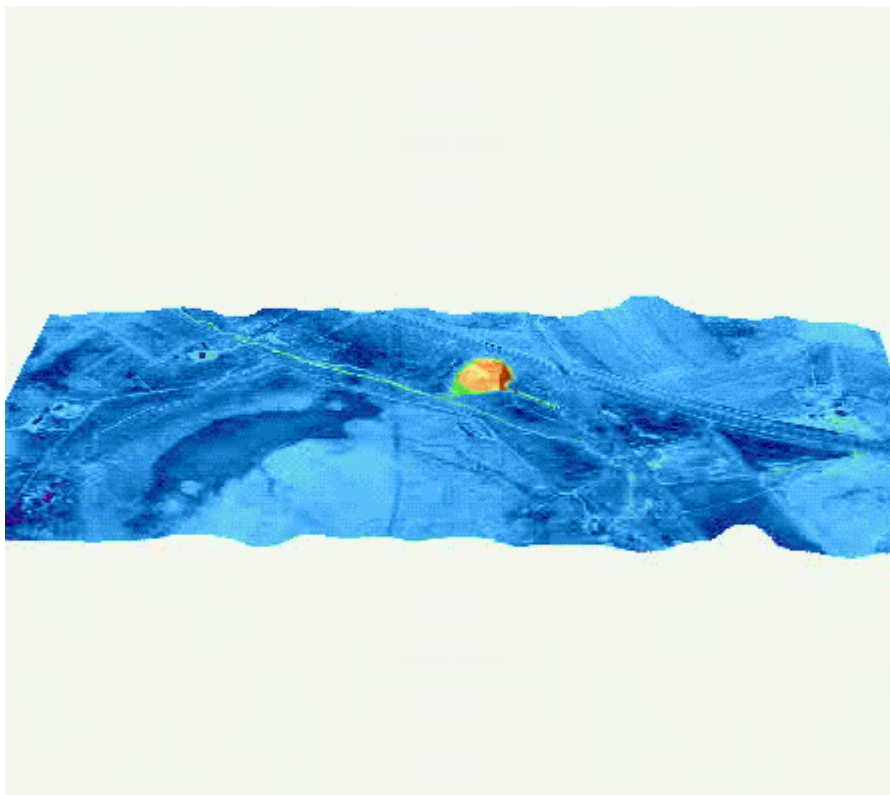


Polynomial Image Rectification

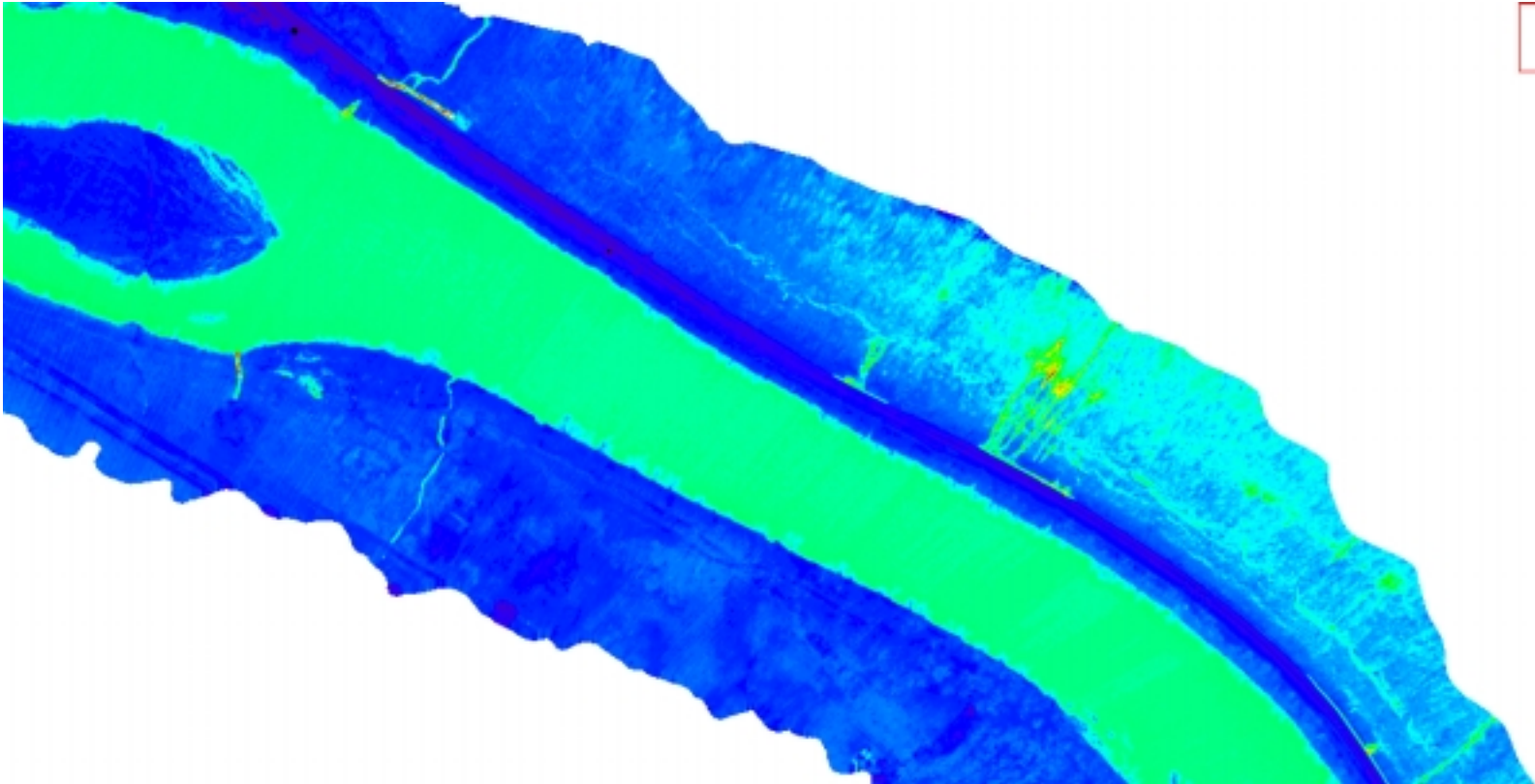
Ground Control Point (GCP) pairs are selected from reference map/image and corresponding locations on uncorrected image



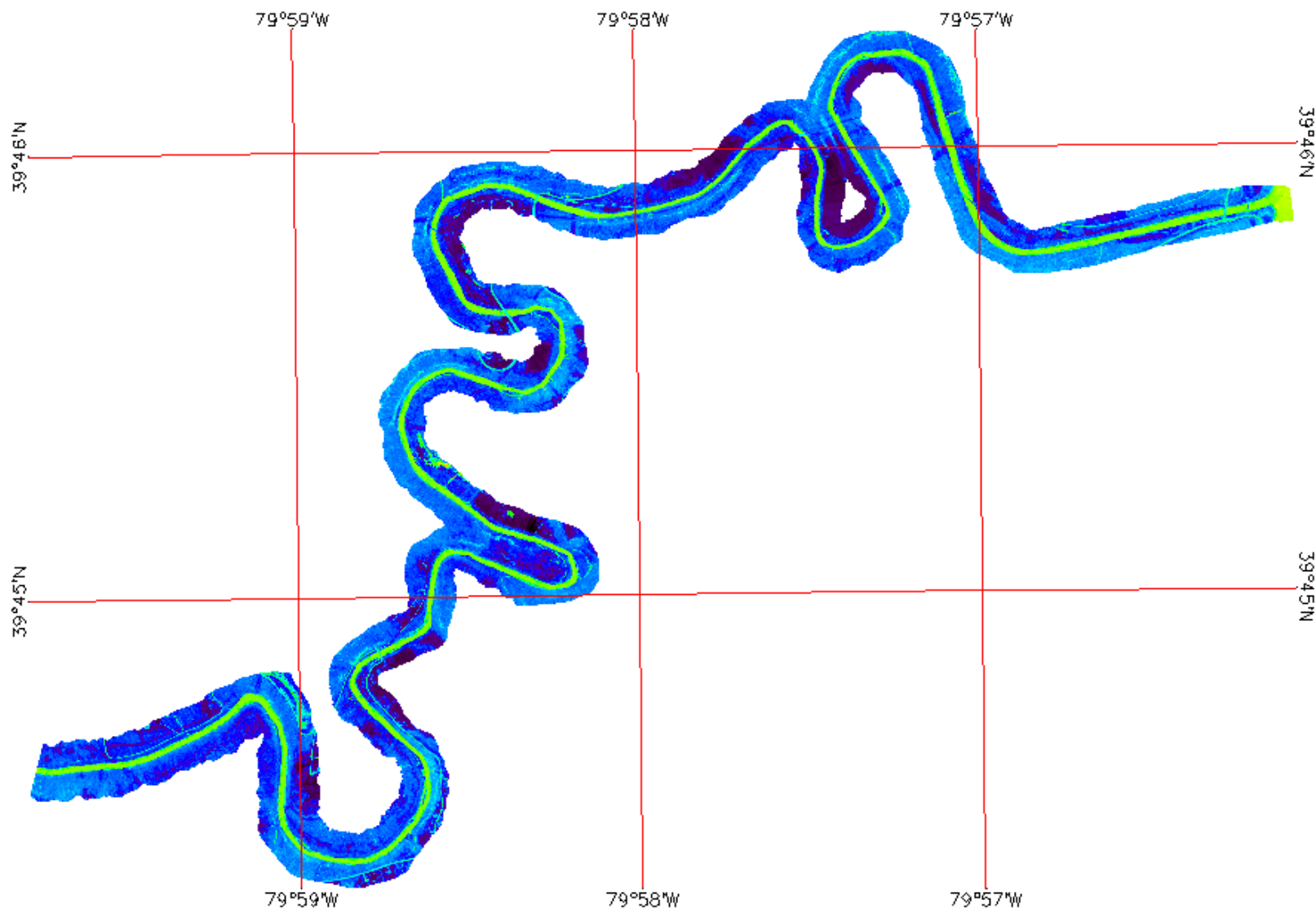
Wilson Run Site Fly-Through



Broad Ford Area Youghioghenny River (near Connellsville, PA)

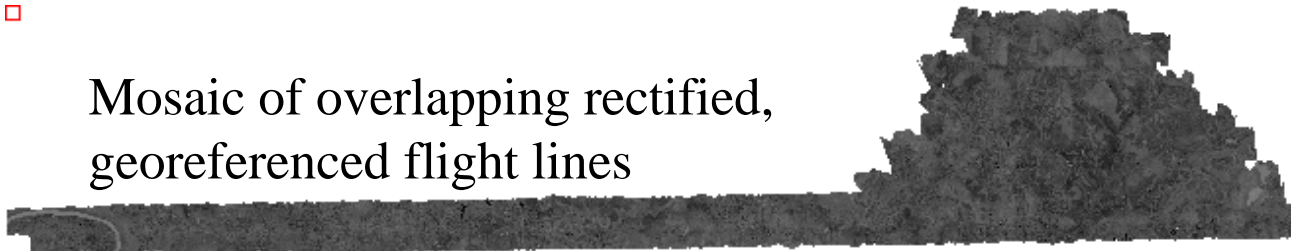


Dunkard Creek



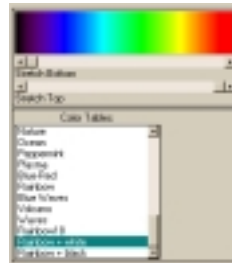
Processing Imagery Data

Single georeferenced and rectified flight line

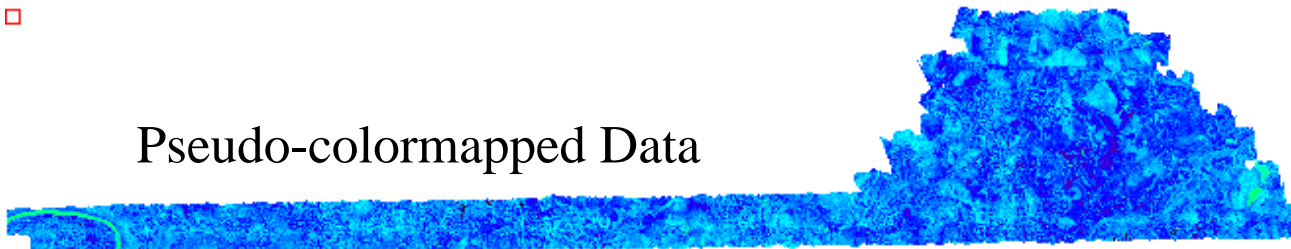


+

Colormapping
Algorithm



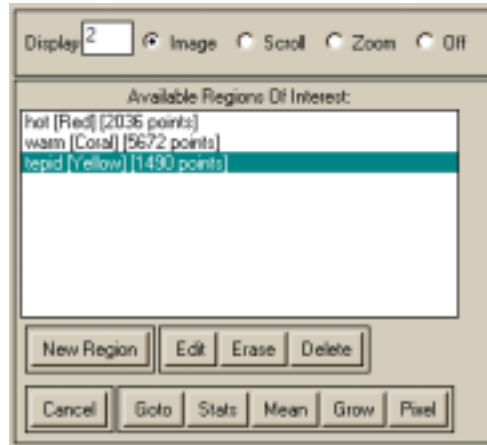
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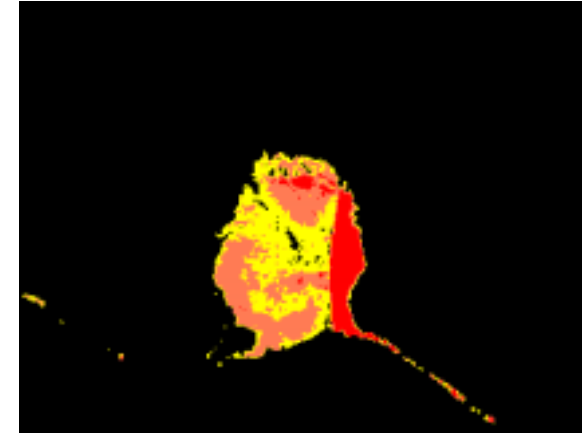
Supervised Image Classification



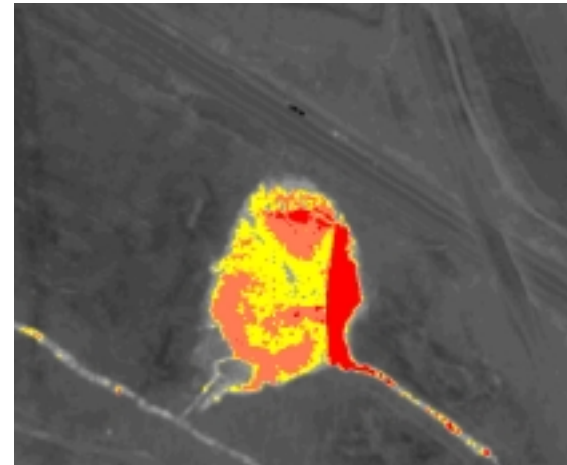
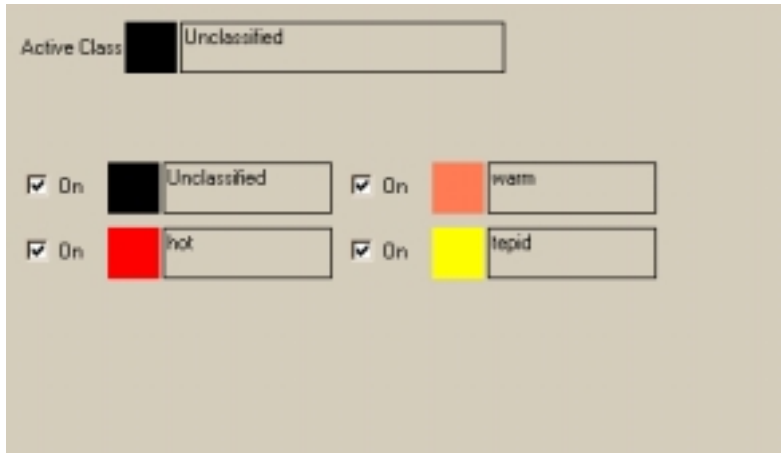
Unclassified Image



Define Training ROIs

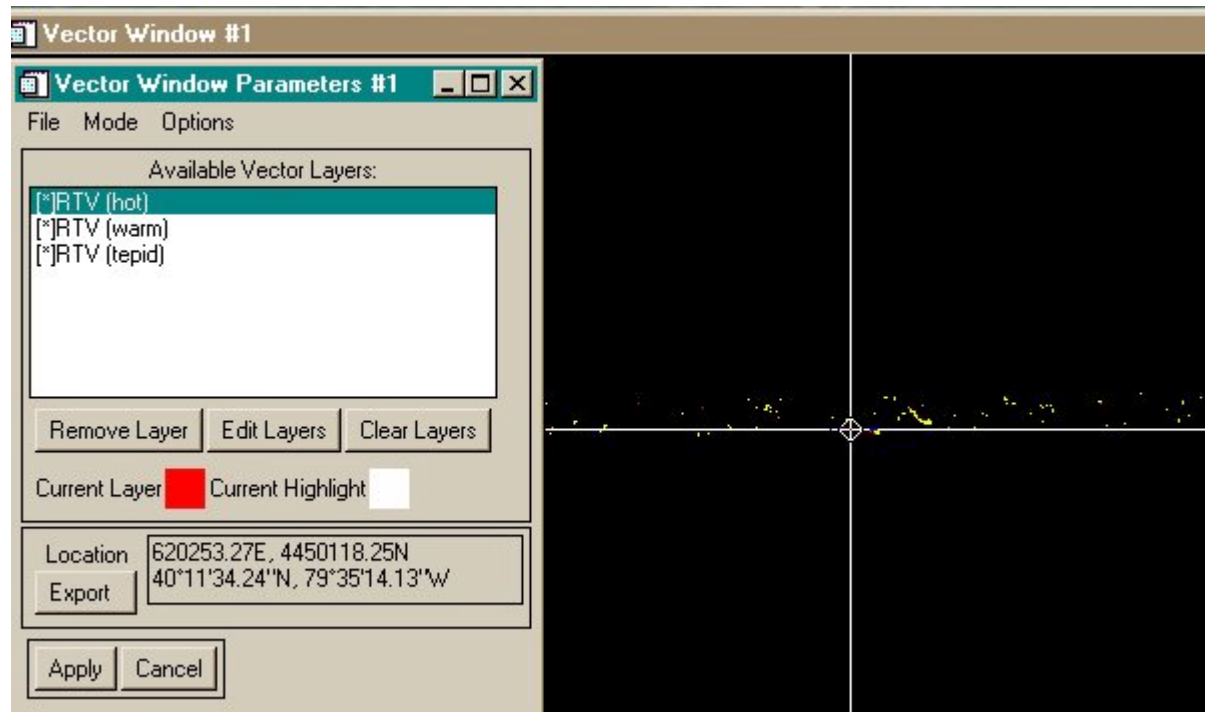


Classification Layers

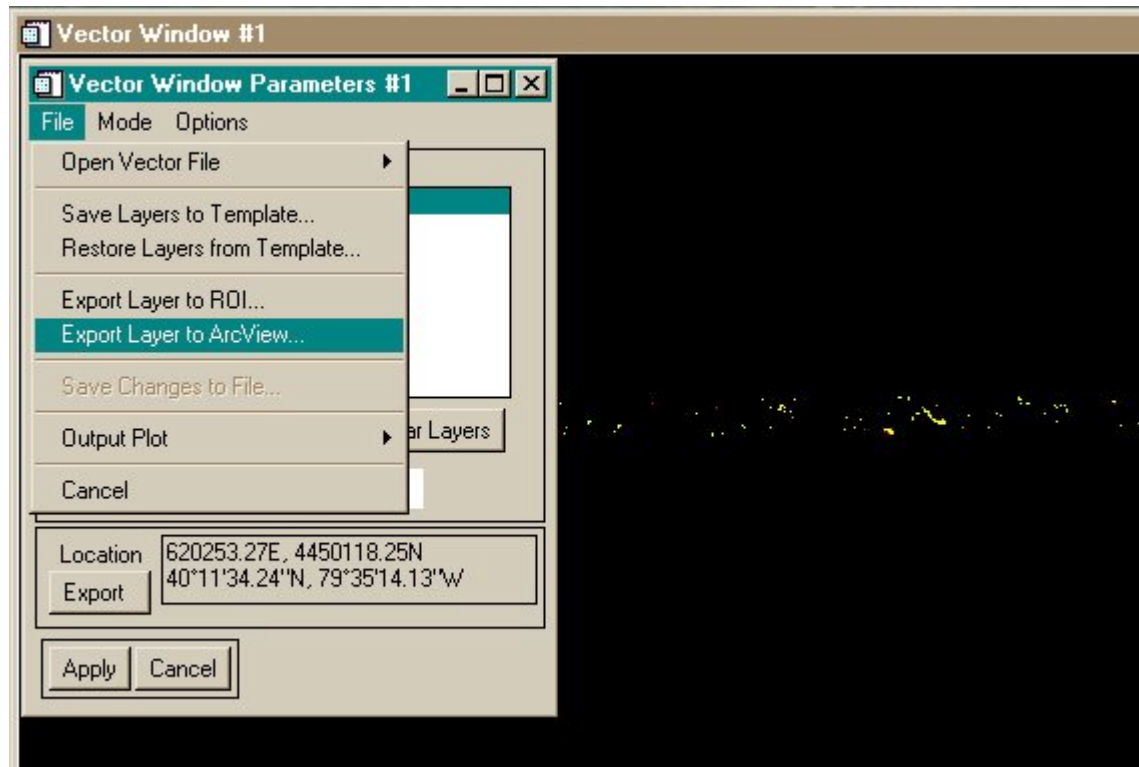


Classification Overlay

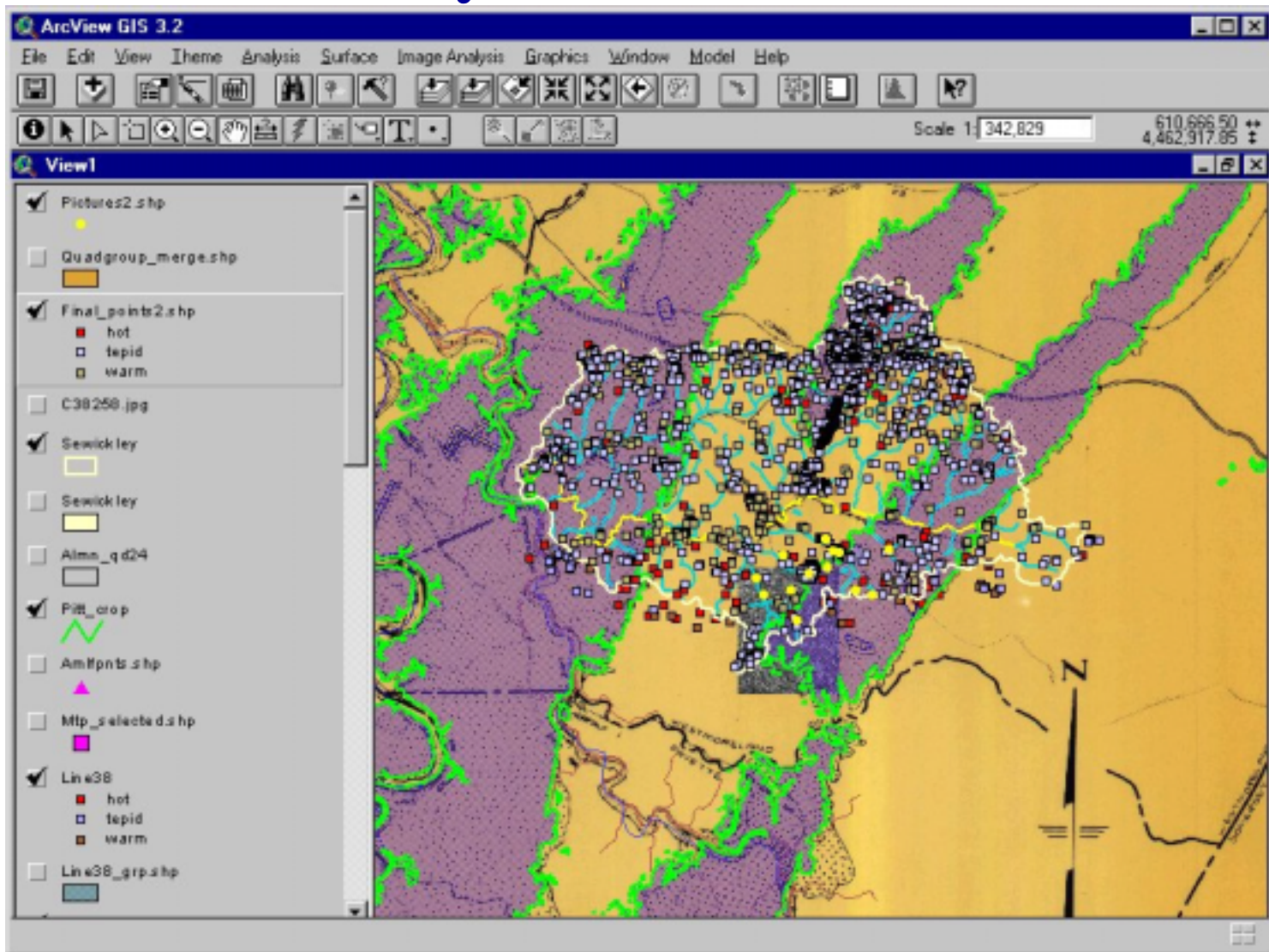
Post Classification Processing Classified Image to Vector Layers



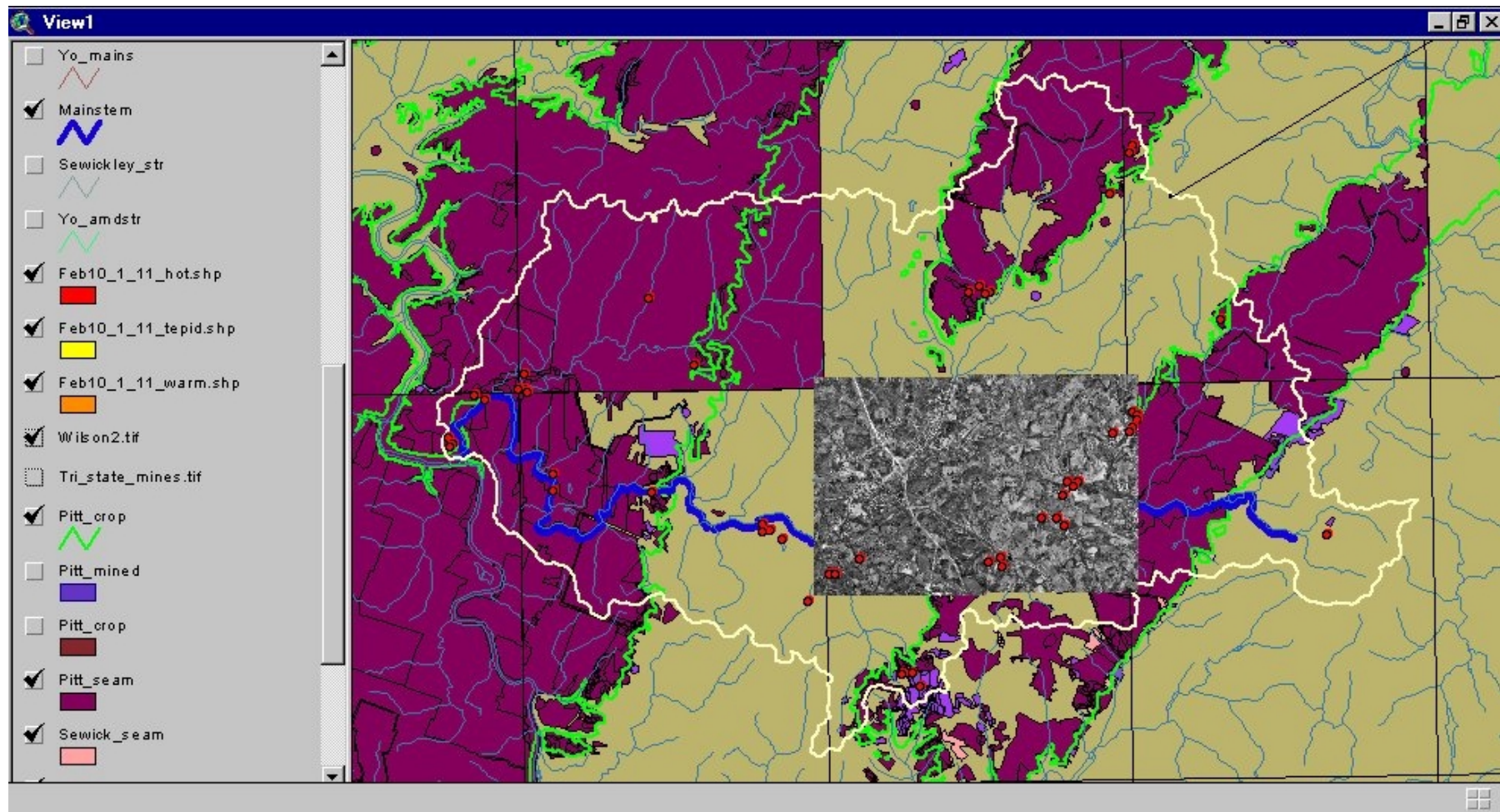
Vector Layer to Shapefile Conversion



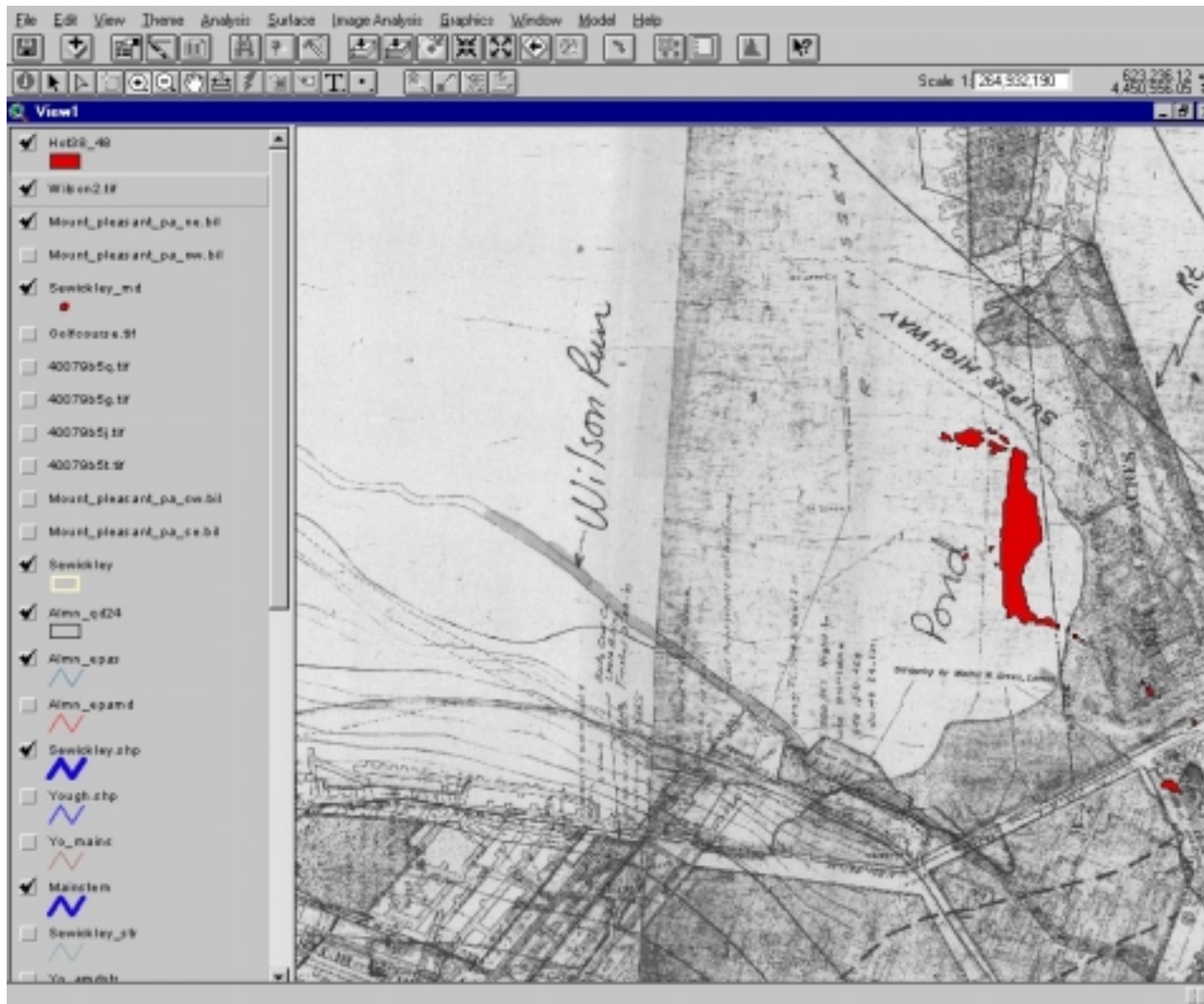
Distribution of Thermal Anomalies in Sewickley Creek Watershed



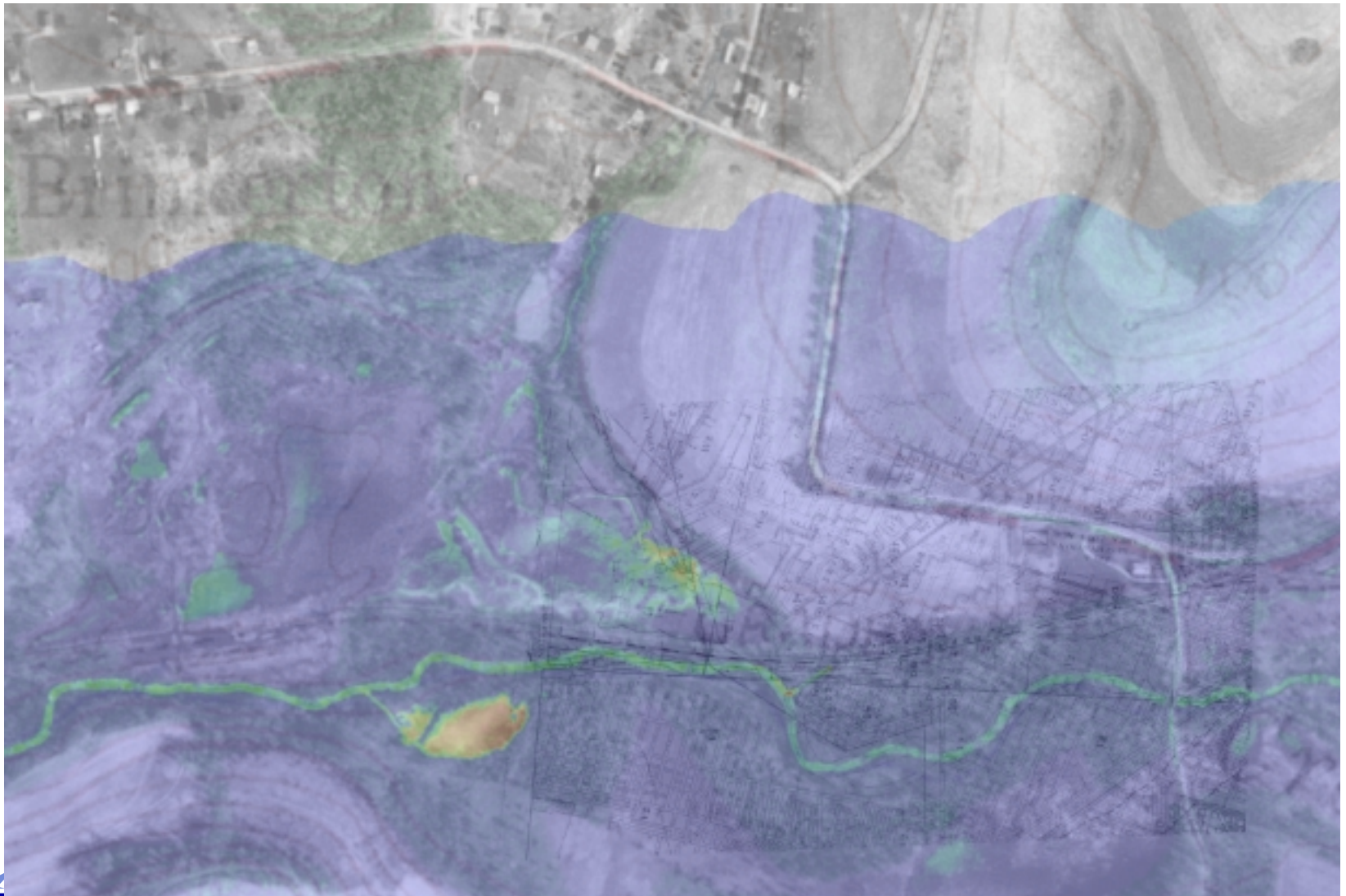
Sewickley Creek Watershed GIS

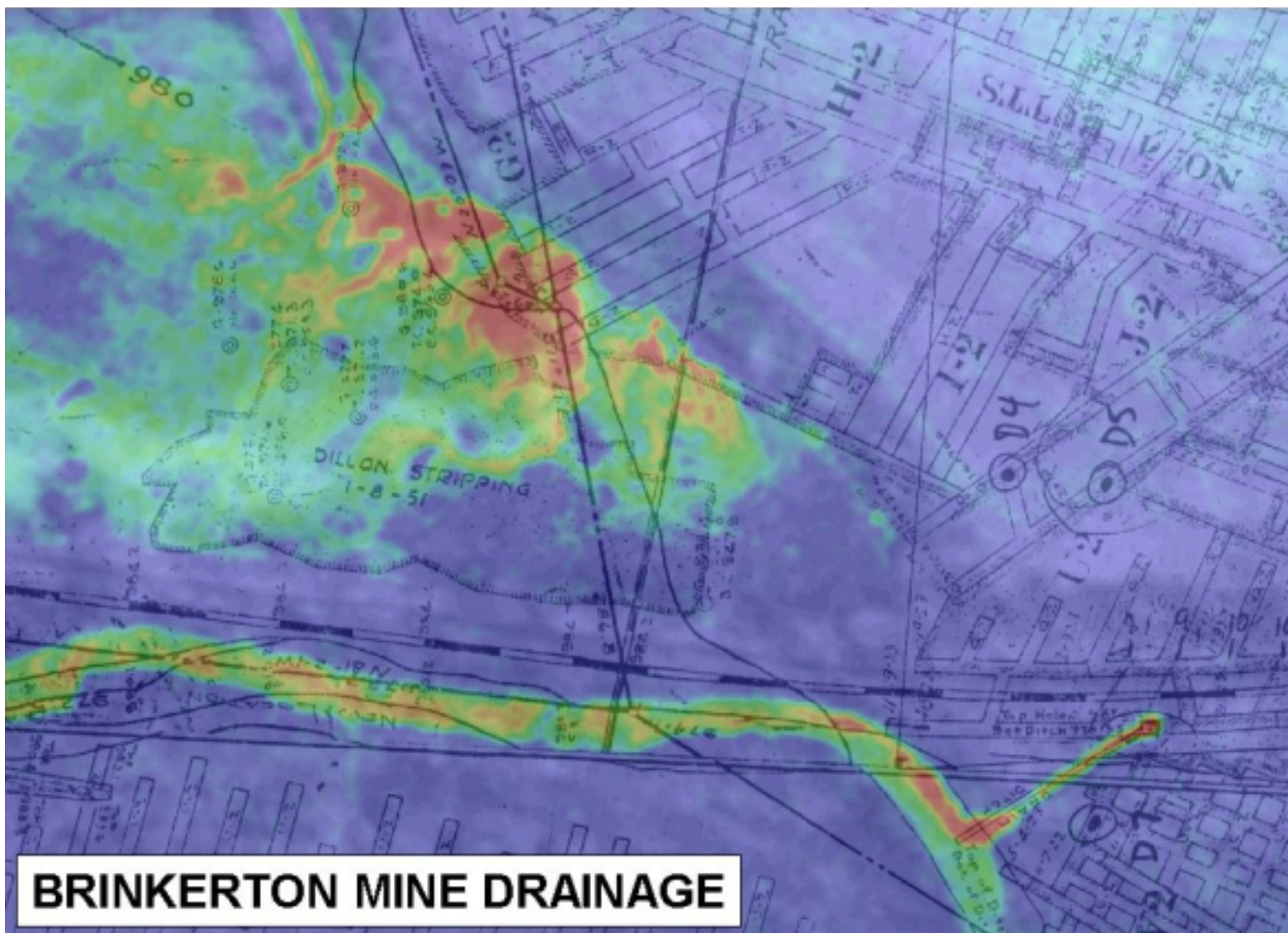


Mine Map Underlay at Wilson Run Site



Brinkerton Site – composite image





Sewickley Creek Watershed Infrared Anomaly GIS database

ArcView GIS 3.2

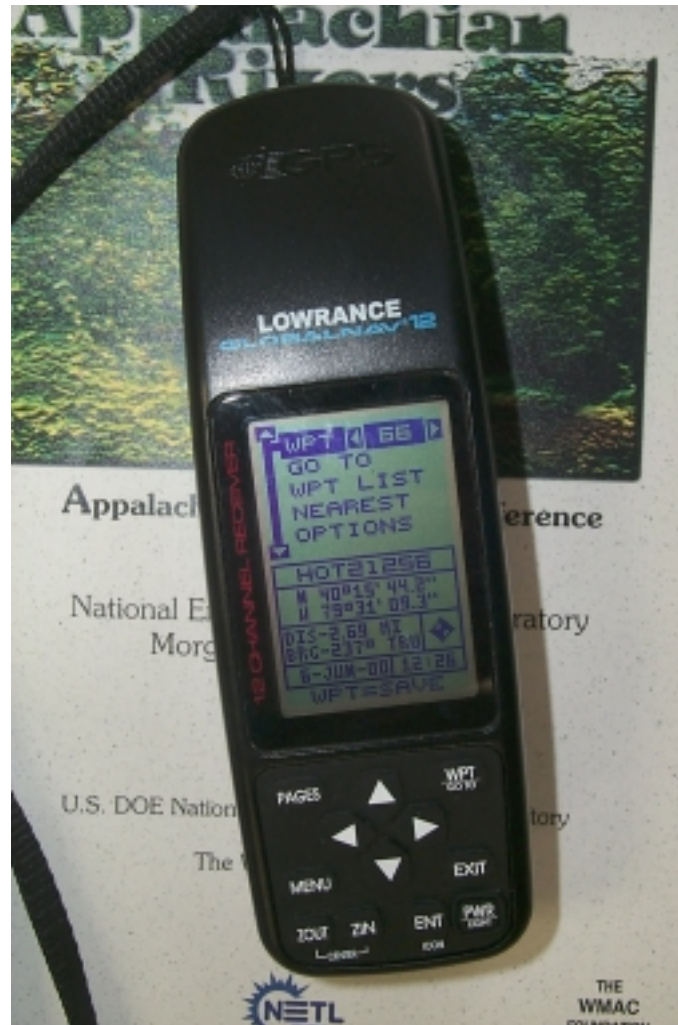
File Edit Table Field Window Help

1 of 11359 selected

Attributes of Final_points2.shp

Shape	Line01	Line01_id	Project_id	Dlat	Dlong	Id	Temp_code	Line	Area	Group_pos
Point	0	0	tepid21187	40.27073	79.55862	187	tepid	21	0.4223	
Point	0	0	tepid21188	40.27064	79.55396	188	tepid	21	2.9569	
Point	0	0	tepid21189	40.27061	79.55392	189	tepid	21	1.2660	
Point	0	0	tepid21191	40.27060	79.55391	191	tepid	21	0.4223	
Point	0	0	tepid21190	40.27059	79.55396	190	tepid	21	1.2693	
Point	0	0	tepid21192	40.27059	79.55888	192	tepid	21	1.2644	
Point	0	0	tepid21193	40.27057	79.55887	193	tepid	21	0.4231	
Point	0	0	tepid21194	40.27055	79.55885	194	tepid	21	0.4215	
Point	0	0	tepid21195	40.27053	79.55883	195	tepid	21	0.4215	
Point	0	0	tepid21196	40.27044	79.55842	196	tepid	21	0.4223	
Point	0	0	tepid21197	40.27039	79.55858	197	tepid	21	0.4223	
Point	0	0	tepid21198	40.27037	79.55859	198	tepid	21	1.2669	
Point	0	0	tepid21199	40.27035	79.55853	199	tepid	21	2.1073	
Point	0	0	tepid21200	40.27019	79.55939	200	tepid	21	0.4231	
Point	0	0	tepid21201	40.27017	79.55939	201	tepid	21	0.4231	
Point	0	0	tepid21202	40.27016	79.55937	202	tepid	21	0.4215	
Point	0	0	tepid21204	40.26998	79.55990	204	tepid	21	0.4223	
Point	0	0	tepid21203	40.26997	79.55978	203	tepid	21	1.2669	
Point	0	0	tepid21205	40.26944	79.56258	205	tepid	21	0.4223	
Point	0	0	tepid21207	40.26943	79.56278	207	tepid	21	0.4223	
Point	0	0	tepid21206	40.26943	79.56276	206	tepid	21	0.4223	
Point	0	0	tepid21208	40.26942	79.56271	208	tepid	21	0.4215	
Point	0	0	tepid21209	40.26941	79.56293	209	tepid	21	0.4223	
Point	0	0	tepid21210	40.26927	79.56356	210	tepid	21	0.4215	
Point	0	0	tepid21211	40.26927	79.56419	211	tepid	21	1.2644	
Point	0	0	tepid21213	40.26915	79.55742	213	tepid	21	0.4223	1
Point	0	0	tepid21214	40.26915	79.55736	214	tepid	21	0.4215	
Point	0	0	tepid21212	40.26915	79.55740	212	tepid	21	1.2677	
Point	0	0	tepid21215	40.26920	79.56438	215	tepid	21	0.4231	

Field Reconnaissance - GPS



Field Reconnaissance

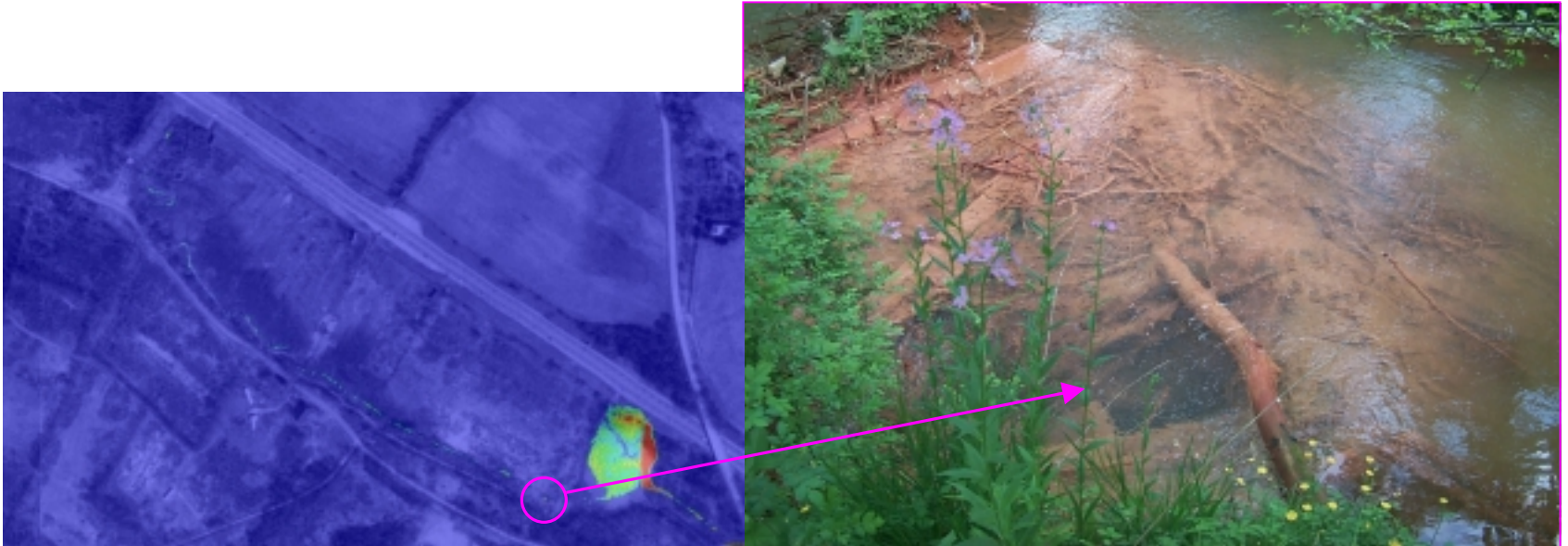
- **Site Visit Data**
- **Site Conditions**
 - Hydrologic condition
 - GPS location of feature (latitude/longitude, DD:MM.M)
- **Field Water Quality**
 - pH
 - Specific conductance
 - Dissolved O₂
 - Temperature
 - Flow rate
 - Sewage odor
- **Photo Identification**
- **Site Description/General Observations**



GPS Position Validation



AMD Discharge near Wilson Run Site



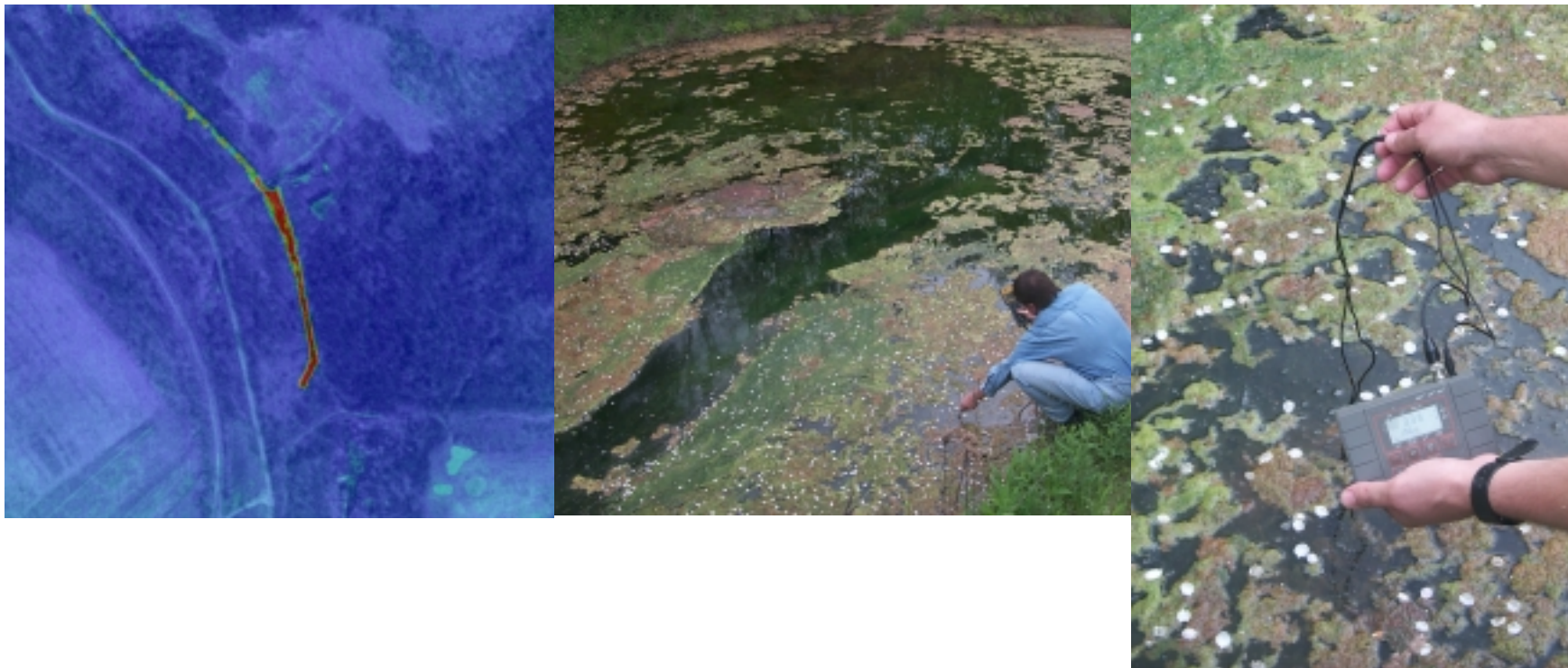
Possible graywater discharge located during field reconnaissance



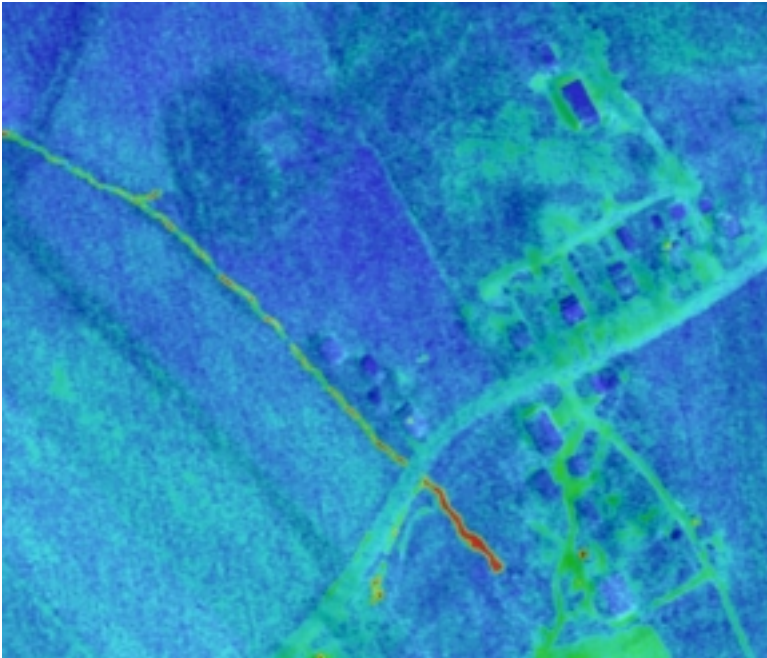
Untreated Sewage



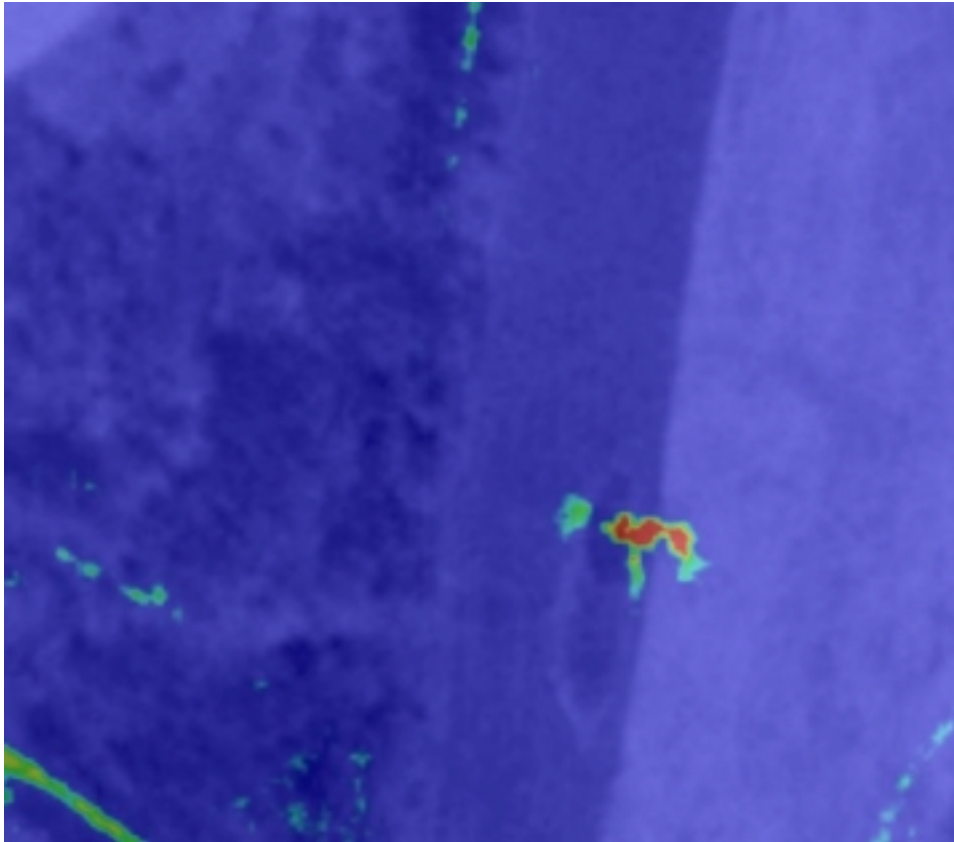
AMD near Lauffer, PA



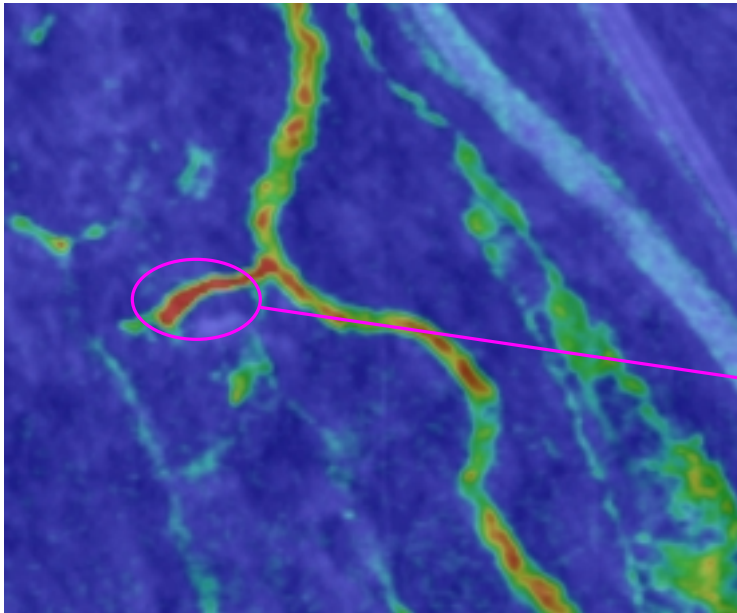
Graywater Discharge




Gas Dryer



AMD Discharge to Buffalo Run



Field Data Entry Form

		NETL CLEAN WATER TEAM FIELD SAMPLE REPORT FORM		
SITE VISIT DATA				
Project ID		Acting Party		
Sample Date		Organization		
Sample Time		Sample ID		
SITE CONDITIONS				
Hydrologic Condition		Latitude (in DM)		
		Longitude (in DM)		
FIELD WATER QUALITY				
pH		Dissolved Oxygen	mg/l	
Specific Conductance		Temperature	deg-C	
Sewage Odor?	<input type="checkbox"/>			
Flow Rate		cubic ft per second		
PHOTO IDENTIFICATION				
Photo #1 ID	Photo #2 ID	Photo #3 ID	Photo #4 ID	Photo #5 ID
Site Description				

